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Managing *Eucalyptus* plantations under global changes

Abstracts Book

Eucalyptus plantations & deep groundwater: the effects of different potassium and water supply regimes on soil water uptake and water table depth.

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Although large amounts of potassium (K) are applied in tropical crops and planted forests, little is known about the interaction between K nutrition and water supply regimes on water resources in tropical regions. This interaction is a major issue because climate change is expected to increase the length of drought periods in many tropical regions and soil water availability in deep soil layers is likely to have a major influence on tree growth during dry periods in tropical planted forests.
In this study, we described a modeling approach to quantify water fluxes in a *Eucalyptus* throughfall exclusion experiment in Brazil to gain insight into the combined effects of K deficiency and rainfall reduction (37% throughfall exclusion) on the water used by the trees, soil water storage and water table fluctuations over the first 4.5 years after planting.

Although the mean water withdrawal from depths of over 10 m amounted to only 5% of canopy transpiration in K-fertilized plantation with undisturbed rainfall (+K+W), the proportion of water taken up near the water-table was much higher during dry periods. Under contrasted K availability, water withdrawal was more superficial for –K than for +K. Under rainfall exclusion,

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water was withdrawn in deeper soil layers for –W than for +W, particularly over dry seasons.

A comparison of canopy transpiration in each plot with the values predicted for the same soil with the water content maintained at field capacity, made it possible to calculate a soil-driven tree water stress index for each treatment. The soil-driven tree water stress index was 166% higher over the first 4.5 years after planting for –W than for +W, 76% lower for –K than for +K, and 14% lower for –K–W than for +K+W.

Over the study period, deep seepage was higher by 371 mm yr–1 (+122%) for –K than for +K and lower by 200 mm yr–1 (–66%) for –W than for +W. Deep seepage was lower by 44% for –K–W than for +K+W. At the end of the study period, the model predicted a higher water table for –K (10 mbs for –K+W and 16 mbs for –K–W) than for +K (16 mbs for +K+W and 18 mbs for +K–W).
Our study suggests that the depth of the soil should be a major criterion for the selection of future afforestation areas and that flexible fertilization regimes could contribute to adjusting the local trade-off between wood production and demand for soil water resources in planted forests.

Keywords: Water resources, Nutrients, Groundwater, Brazil, Eucalyptus, Deep roots